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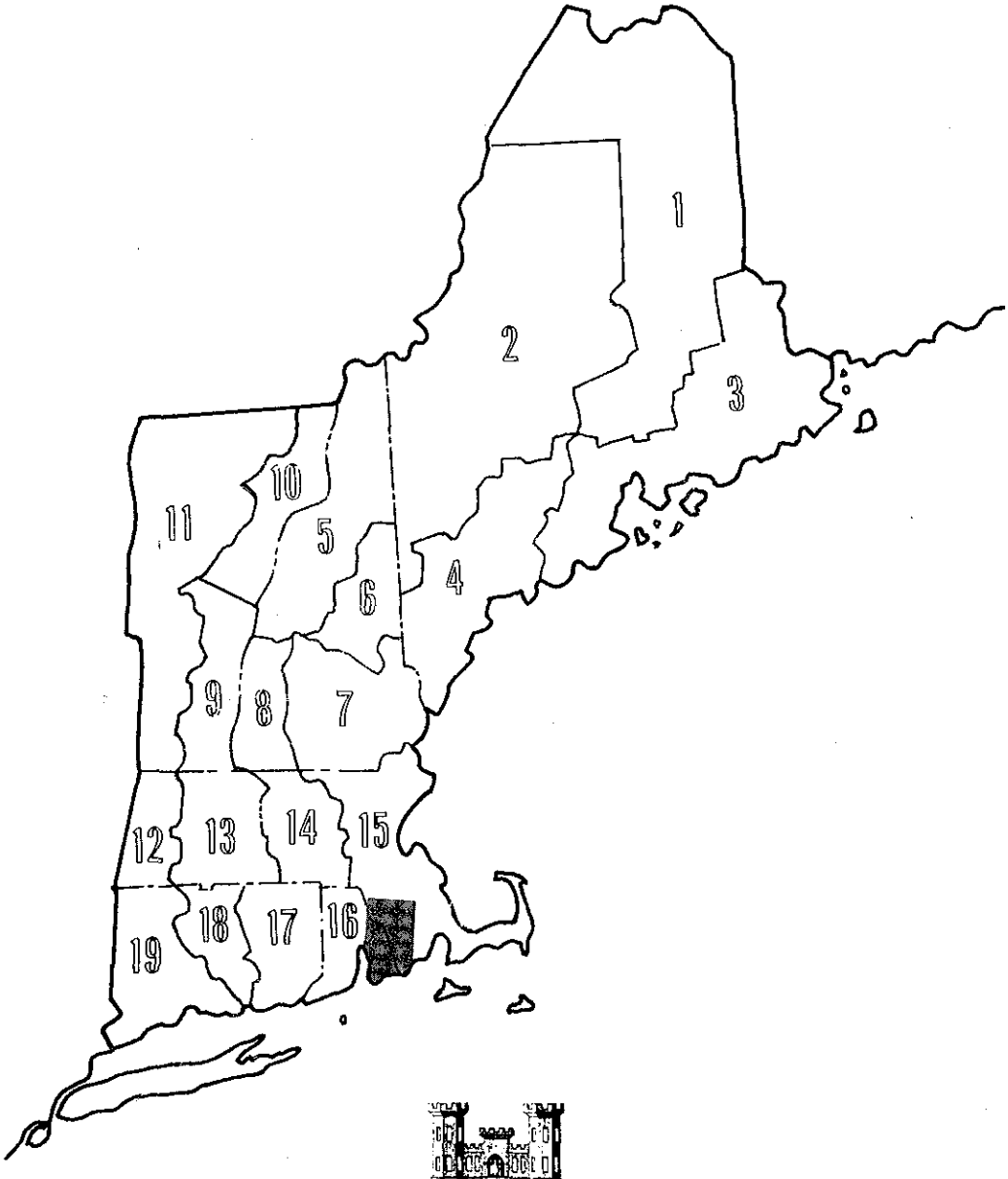
#11

NORTHEASTERN UNITED STATES WATER SUPPLY STUDY

NEW BEDFORD, FALL RIVER AND TAUNTON

(PART OF OBE SUB-REGION 15)

INTERIM MEMORANDUM NO. 1



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

APRIL 1968

NORTHEASTERN UNITED STATES WATER SUPPLY STUDY

INTERIM MEMO NO. 1

SOUTHEASTERN MASSACHUSETTS TRI-CITY AREA
(Part of OBE SUB-REGION 15)

NEW ENGLAND DIVISION
CORPS OF ENGINEERS, U.S. ARMY

APRIL 1968

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ABSTRACT

The Tri-City area is analyzed from an historical, geologic and topographic aspect. The present population, water supply and water demand are discussed, and projections made for the population and water demand through the year 2020.

Possible sources of water adequate for a regional supply are evaluated, and both a recommended and an alternate plan are discussed.

1. PURPOSE OF REPORT

This interim memo is being submitted in accordance with scope of work detailed in Memorandum dated 21 November 1967, as part of this Division's participation in the Northeast Water Supply Study for the New England Area.

2. SCOPE OF STUDIES

a. General Information. Preliminary studies and investigations of reconnaissance scope have been made to determine water supply requirements for Bristol and Plymouth Counties in southeastern Massachusetts. Studies are based upon personal contact with various city water departments and their consultants, as well as representatives of the Massachusetts Department of Public Health; documents of the Massachusetts Senate and House; and publications of U.S.G.S.; HEW, and other agencies.

The findings of this report are oriented toward municipally owned systems that are suppliers of both domestic needs and also the needs of industrial users with small or moderate requirements. Industrial users with large requirements usually have their own supply (for example: the brass plant in New Bedford and the chemical company in Fall River) and therefore are not included in this discussion. In order to provide complete information on the total demand, a questionnaire similar to the one designed by NED (but not yet used) should be sent to selected manufacturing and other operations.

b. Topographic surveys. Topographic information was obtained from U.S. Geological Survey Maps, and from the Engineering and Water Departments of New Bedford, Taunton and Fall River as well as their consulting engineers.

c. Geologic and Subsurface Information. Subsurface data was obtained from U.S. Geological Survey Maps, from interviews with U.S.G.S. representatives, and a report by the Weston Geophysical Engineers, Inc., Weston, Mass., entitled "Compilation of Geophysical Studies Throughout Massachusetts."

d. Office Studies. Office studies consisted of projecting present water demands and supplies, and determining the projected deficiencies for the various towns within and abutting the New Bedford, Fall River and Taunton so-called Tri-City area.

e. Field Reconnaissance. Field reconnaissances, consisting of cursory vehicle inspections, were made of the site of potential improvements and/or new facilities.

3. PRIOR REPORTS

No prior reports have been transmitted by NED on the specific subject of the Northeast Water Supply Study. The NENYIAC study of 1954 contains information that is generally applicable to "NEWS" in such areas as topography and geology, surface and groundwater availability, pollution and recreation. In addition are documents published by the Massachusetts House, No. 3774 and No. 4049, which are reports of the Water Resources Commission relative to water resources of Bristol and Plymouth counties.

4. DESCRIPTION OF AREA

a. General. Bristol County and adjacent areas of southeastern Massachusetts have an average elevation of less than 100 feet above MSL. The many shallow valleys offer very few favorable locations for construction of storage reservoirs of large capacity. Moreover, the valleys generally contain extensive areas of swamp, producing highly colored and otherwise objectionable water supply quality. However, there are several large natural ponds in this area of approximately 600 square miles. (Refer to Plate 1). These large natural ponds are: Upper and Lower Watuppa, Long Pond, Assawompsett, Pocksha, Great Quittacas and Little Quittacas Ponds. Lower Watuppa is used only for industrial purposes, but the other named Great Ponds, totaling 12.1 sq. mi. of water surface, are used as water supply sources for New Bedford, Fall River and Taunton, and the other municipalities served by these three cities. The region has relatively small rivers, the largest being the Taunton and the Ten Mile Rivers, which drain approximately 520 and 49 square miles respectively, but much of this watershed is outside of the Tri-City area.

Some ponds are subject to pollution, but most of the rivers are seriously polluted, with effective improvement some years off. The rainfall varies from 30" in drought years to as much as 58". The long term average rainfall approximates 44" with about one half reaching the streams and the remainder entering the ground or lost through evaporation and transpiration. All water supply systems in the area are local rather than regional. Each city or town (with a few exceptions) provides its own supply, conveyance and distribution. Although the municipalities have economic and geographic ties, there is resistance between them concerning diversion of water. The prevailing attitude is that if a regional supply and conveyance system were built to guarantee an adequate amount of water to the user, this resistance would become negligible.

b. Sources of Supply. Since neither the technology nor the economics of desalinization, climate control, or similar techniques appear to be competitive in time to meet urgent (by 1980) needs, the possible sources of supply considered were limited to ground water sources, and surface supplies including the rivers. Ground water sources were found to be inadequate. It is likely, therefore, that the burden will be upon the surface water supplies to meet needs for at least the next fifteen years.

c. Geology and Topography. Information supplied by U.S.G.S. indicates that while the topography is relatively level, the geology is highly irregular. The bedrock is as far as 250 feet below MSL, with several outcroppings, especially northerly of the Fall River and Freetown area. Some bedrock is igneous, and a few of these outcroppings have been worked as granite quarries. Till over the bedrock may be as much as 100 feet thick, but information is incomplete in most of the area. There is a discontinuous moraine to the south of the Lakeville Ponds, but it is not significant. Much of the lowland area (0 to 100 feet MSL) is glacial lake deposits, with many layers of very fine sand, clay and some gravel, the latter being worked as gravel pits in some areas. Because of the irregularity of the geology, those potential reservoir sites that are afforded by natural topography would have to be investigated by borings, test pits, trenches, or other means of subsurface investigation as deemed necessary.

d. Maps. Topography of the southeastern Massachusetts area is shown on the U.S. Dept. of Interior Geological Survey maps at a scale of 1:24,000, 7½ minute series, with 10-foot contour intervals.

5. WATER SUPPLY HISTORY

Dug wells for both individual and municipal use, but no distribution systems, were in use in this area until about 1800. At that time, various people began organizing private water companies to dig wells and distribute water, usually through log pipes, to the populated downtown districts of the larger cities and towns. Usually the wells were dug right in the downtown area, even though a better quality water was available outside of town. Because of a series of technical, management and economic problems, these companies usually expired in a relatively few years. About the middle of the 19th century local officials, believing that fishing and agriculture would eventually be replaced by manufacturing as the backbone of their economy, reacted by planning for a more efficient water supply system to provide the larger quantities of water that would be required at the future manufacturing sites.

The City of New Bedford was the first to inaugurate a municipal supply and distribution system. Their reservoir, located seven miles north of New Bedford in the Town of Acushnet, was completed in July 1867. It is 300 acres in area, with an average depth of 8 feet and has a capacity of 400,000,000 gallons. However, since the watershed has a limited area of only 5.1 square miles, water level could not be maintained during the summer months. Lower levels result in highly colored, strong tasting and smelling water created by the vegetable matter alternately growing and rotting. Increasing demand intensified the problem, and in 1886 an emergency connection was made to Little Quittacas, which is about 10 miles north of New Bedford. It is the smallest of the so-called Lakeville Ponds. In 1899, a new system was installed, which used the Little Quittacas water, while the older Acushnet system was put on standby. The 1899 supply system currently in use is capable of meeting New Bedford's current

demands and those required over the next 25 or 30 years.

The second largest city in the Tri-City area is Fall River. A private water supply company was founded in 1826. For the next 70 years there developed friction between this private company and the City of Fall River over the rights to the water of North Watuppa Pond. In 1892, the private company sold its rights to the city. This action was later followed by the Massachusetts Legislative Acts of 1938 which authorized the city to take certain lands for water supply purposes. Under this Act, an industrial supply at Noquochoke Lake was also developed. In 1949, water was pumped for the first time from Noquochoke Lake into North Watuppa (the Fall River Reservoir) during a period of water shortage. Although the Massachusetts Department of Public Health is not happy with the latter arrangement, it has allowed it to continue on a year-to-year basis while applying pressure to Fall River officials to provide a more satisfactory water supply source to supplement its North Watuppa Reservoir. In the most recent move the city has obtained funds (assisted by a $1,300,000 HUD grant) to prepare plans and construct a 6 MGD reservoir to be located in the Copecut area (about 5 miles east of the city and north of Noquochoke Lake). Fall River also has certain rights in Long Pond, one of the Lakeville Ponds (see Plate No. 1), but these rights have never been exercised because of legal and financial reasons.

Taunton, the third city in the Tri-City area, has had a municipal supply and distribution system since 1876. Their source is Assawompsett Pond (one of the Lakeville Ponds), from which the water is pumped up to Elders Pond, their reservoir. The water is conveyed from Elders a distance of 7 miles down to the Taunton pumping station and distribution system through a 30" gravity main. In November 1967, with help from a HUD construction grant, a new 24" force main was installed. Taunton has an adequate supply of water for about the next 25 years, and except for some minor problems in distribution, is in reasonably satisfactory condition.

Between and cloistered about the three major cities of New Bedford, Taunton and Fall River are 18 towns that are, somewhat arbitrarily, considered to be within the Tri-City area. These towns have their own water supply, but some buy from the larger cities, and a few have no public water supply but are serviced through private wells. These 18 towns are:

Acushnet	Lakeville	Rehoboth
Berkley	Marion	Rochester
Dartmouth	Mattapoisett	Seekonk
Dighton	Middleborough	Somerset
Fairhaven	Norton	Swansea
Freetown	Raynham	Westport

6. PRESENT WATER SUPPLY SITUATION

Two of the three larger cities, that is New Bedford and Taunton, have enough source water for 15-20 years. Fall River has had a shortage for several years, and has had to pump a poor quality of water from Noquochoke, primarily a source of industrial water.

North Watuppa is controlled by Fall River, and the water rights to South Watuppa are owned by a large chemical company operating in the city.

The Lakeville Ponds located about 10 miles east of the Watuppa Reservoir, consist of Long Pond, Assawompsett Pond, Pocksha Pond, Great Quittacas and Little Quittacas. The water rights to these ponds are granted to the three large cities as follows:

Long Pond	-	Fall River
Assawompsett Pond	-	Taunton
Pocksha	-	New Bedford
Great Quittacas	-	New Bedford
Little Quittacas	-	New Bedford

There are no other existing major bodies of water available for use by other municipalities. Consequently, neighboring towns have had to rely upon ground water where available. Some have planned for diversions and impoundments of small streams but most would have safe yields of only from 3 to 8 MGD. Generally, the estimated cost for surface dams in most cases could not be justified, so smaller sums were expended in searching for additional ground water supplies.

Ground water is not readily available in this part of Massachusetts in quantities large enough to support significant water supplies. The lack of both surface sites and ground water availability coupled with the recent drought, has emphasized the urgency of the water supply problem particularly to the "have not" towns as well as the more established older systems. The problem is not merely to meet existing demand, as representatives of neighboring towns in the area have stated that a lack of water has halted their growth, both residential and industrial. Even if a water supply adequate to meet present needs could be provided, additional water will be required in order to meet the demands for the desired growth.

7. PROJECTED FUTURE WATER REQUIREMENTS

The population projections which follow are based on the "Projective Economic Studies of New England," performed for NED by Arthur D. Little, Inc., in 1964 and 1965.

The population projection (in 1,000's) for the area is:

	1960	1970	1980	1990	2000	2010	2020
New Bedford	110	124	146	169	197	233	273
Fall River	100	112	130	154	180	211	249
Taunton	42	48	52	68	82	96	114
Nearby Towns*	64	71	83	98	115	135	160
TOTALS	316	355	411	489	574	675	796

* Total of 18 nearby towns that might be included in a regional water supply system.

The projected water demand, in MGD is:

	1960	1970	1980	1990	2000	2010	2020
New Bedford	19.2	21.6	25.3	29.1	34.3	40.3	47.0
Fall River	10.3	11.6	13.4	15.9	18.5	21.8	25.8
Taunton	4.8	5.5	6.0	7.8	9.4	11.0	13.0
Nearby Towns	8.0±	8.9	10.4	12.3	14.4	16.9	20.0
	42.3	47.6	55.1	65.1	76.6	90.0	105.8

The present safe yields of the various systems are:

New Bedford	35 MGD
Fall River	10 MGD
Taunton	8 MGD
Nearby Towns*	3± MGD

* Estimate: Records are incomplete and personal contact has not been made with all the towns. Some of the smaller towns do not have a public water supply yet.

8. POSSIBLE SOURCES OF WATER FOR A REGIONAL SUPPLY

This report is concerned principally with "urgent" water supply needs (by 1980). Any solutions proposed are based on present day technology and techniques. Solutions such as desalinization, climate control and re-cycling of water would be viewed as alternatives for meeting needs beyond the 1980 period. The potential sources investigated included:

a. Ground water.

b. An estuary impoundment on the Taunton River.

c. Individual surface reservoirs on those more favorable tributaries and smaller streams within the general Tri-City area.

d. Extend beyond present supply radius for additional watersheds.

e. Off-stream impoundments that receive diversions of spring flows from larger tributaries.

f. Extend the MDC system to include the Tri-City area.

Analysis of these possibilities indicates the following:

a. Ground water is difficult to locate in sufficient supply, even for small towns, and there are no known locations that would provide the quantities needed for a regional supply system.

b. Estuary impoundment of the Taunton River to be used as a regional supply has been estimated as being capable of providing up to 80 MGD safe yield. Cost estimate for a 40 MGD plant (with capability of expansion to 80 MGD), including treatment facilities, conveyances, dam, pumping station, etc., is $22,000,000 (estimates taken from an A&E paper dated January 1965). Cost of treated water would be 15¢ per thousand gallons, on a basis of 40 MGD. Disadvantages of this alternative are the poor quality of water during low-flow periods, as well as the possibility of salt water intrusion. The ecological side effects from such an impoundment would also have to be considered.

c. Impoundments in the other areas would not provide enough water to permit consideration of a regional supply. The use of a series of several small reservoirs as part of a regional system would entail a complex network of interconnecting conveyances, all adding to both capital cost and also to operation and maintenance costs.

d. Extending beyond the present supply radius to reach additional watersheds is impractical for two reasons: (1) prior claims upon nearly all lakes, streams and other sources of water, and (2) because of the topography, the individual watersheds produce only a few MGD, effecting a high cost per MGD actually delivered.

e. An off-stream impoundment to be filled by diverting the Spring peak flows would provide high quality water, and would be economically feasible if such a large impoundment, strategically located, could be built. The Copecut watershed is centrally located and also has a steep-walled valley capable of an impoundment 60 ft. deep and 3 miles long by about 1 mile wide. This proposed reservoir, depending on its final configuration, could hold 70,000 to 80,000 acre feet. Preliminary cost estimates by NED indicate that the reservoir without conveyance, pumping or purification facilities, will cost approximately $8,000,000. It would provide a maximum safe yield in excess of 50 MGD, which would satisfy all future requirements up to the year 2020, as now projected.

f. Extension of the MDC system to include the Tri-City area is not likely for two reasons: cost and supply. An A & E report dated January 1965 estimated the cost of a 10' diameter aqueduct plus a 630 MG reservoir would cost $161,000,000. However, in order to supply this conveyance and reservoir, the Quabbin Reservoir System would have to be enlarged in order to increase the supply of water available. Because of commitments to cities and towns already served by the MDC, most of the scheduled expansion is already planned to meet these requirements.

9. RECOMMENDED ALTERNATIVES FOR FURTHER INVESTIGATION

Assuming the existing water systems of the cities of New Bedford, Fall River and Taunton, and of the towns in the vicinity continue in use, and assuming also that they will continue to use their existing supply, purification and distribution facilities, they could in the future tie into a proposed regional facility. This facility would consist of a major reservoir having a safe yield of 50 MGD, a purification facility, and one or more major conveyances leading to areas of need. Municipalities requiring water could run a line to the nearest regional conveyance.

The regional facilities that could be selected would be either the Taunton River estuary impoundment, or the off-stream estuary impoundment, located in the Copecut area. The decision by Fall River to build a small reservoir in the Copecut area must be noted as a principal item of constraint to a future regional supply. HUD has provided Fall River with a $1,300,000 grant to assist in construction of a 6 MGD reservoir in the Copecut area, which is less than the storage potential available in the Copecut area. The City Council will soon vote whether or not to accept, and also vote on a $1,700,000 bond issue representing the City's share of the project cost. Construction is expected to start before the Summer of 1968, and could be completed by December of 1969.

10. CONCLUSIONS

Although the cities of Taunton and New Bedford have a water supply system adequate up to the year 1990, Fall River and many of the adjacent towns are now in need of water. This need could be met by providing a regional water supply system at Copecut which would also provide water to meet the future requirements of all the cities and towns in this area through the year 2020. Assuming that the action noted in 9 above is consummated by Fall River, the only other alternative at this particular site would be some future multi-stage construction. Such a future modification would effect an increase in storage beyond the natural watershed capabilities of the Taunton River through diversion during high flow periods.

An alternate solution for a regional supply would be the estuary impoundment on the Taunton River. However, the Copecut reservoir is the preferred solution.

It is likely that the city of Fall River will solve its own urgent problem. Since both Taunton and New Bedford have a supply adequate up to the year 1990, we conclude that the three core cities do not have an "urgent" water supply problem. Removing these core cities from the statistical study area would leave 18 towns with a total 1968 population of approximately 69,000 spread over an area of approximately 400 square miles to rely upon their independent resource capabilities. From a practical point of view, until such time as the core cities require an increase in their sources it is not considered practical to radiate separate conveyances for the various bedroom towns.

Although many of these small towns are short of water, the shortages usually have had no serious effect upon their growth. Some towns believe that a shortage of water is inhibiting their industrial and residential development. Actually, it is highly unlikely that water-using industries would move into these towns in preference to established core cities capable of meeting their needs. There may be an occasional small electronics firm, a trucking terminal, or similar low water-use operation that would locate in one or more of the towns.

Findings for this portion of the "NEWS" study are:

a. A regional reservoir in the Copecut area is possible but not needed before 1980, at which time flows from the Taunton River would be required for increasing storage potential. This future design could be coordinated with the current design being planned by Fall River.

b. Assume HUD and Fall River proceed with their planned construction. If this is accomplished, an Interim Report could be performed for the development of a future regional supply. It would involve second stage construction that would take place beyond the 1980 time frame.

c. Additional consideration of the estuary impoundment of the Taunton River for future needs.

It was noted that source estimates for core cities do not reflect industrial requirements other than those needs now supplied by the public systems, with the two exceptions noted, namely the chemical (in Fall River) and brass (in New Bedford) plants. It would be desirable to pursue action to obtain better information concerning industrial needs, utilizing some form of sampling, a questionnaire, or research such as is being performed by the Water Resources Center at Cornell University.

N

TAUNTON

30" C.I.

GRAVITY

24" C.I. FORCE MAIN (1967)

(1896)

MIDDLEBORO

Elders Pond

Assawompset Pond

Pocksha Pond

Great Quittacas Pond

Little Quittacas Pond

Long Pond

Taunton River

PROPOSED ESTUARY DAM

48" STEEL FORCE MAIN (1899)

48" C.I. FORCE MAIN (1927)

Acushnet Reservoir

3'x4' CONDUIT GRAVITY (1869)

Taunton River

Mount Hope Bay

FALL RIVER

North Watuppa Pond

South Watuppa Pond

PROPOSED COPECUT RESERVOIR

High Hill Reservoir

42" C.I. FORCE MAIN (1943)

42" R.C. GRAVITY (1956)

2-36" C.I. GRAVITY (1887,1910)

Noquochoke Lake

NEW BEDFORD

Buzzards Bay

Sakonnet River

NORTHEASTERN UNITED STATES WATER SUPPLY STUDY

TRI-CITY AREA

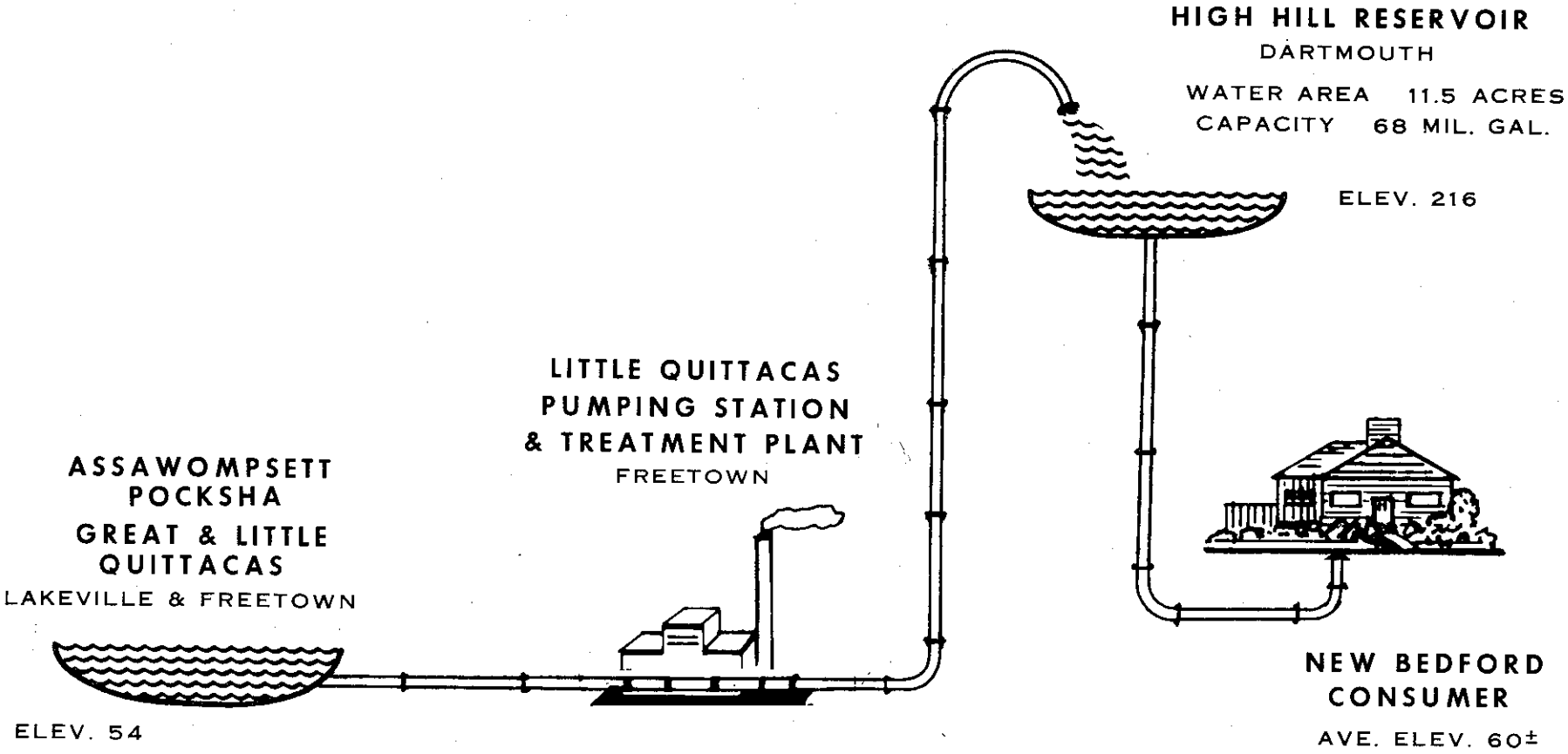
(PART OF OBE SUB-REGION 15)

SHOWING EXISTING CONVEYANCES AND PROPOSED RESERVOIR SITES

SCALE IN MILES

1 1/2 0 1 2 3 4 5 6 7

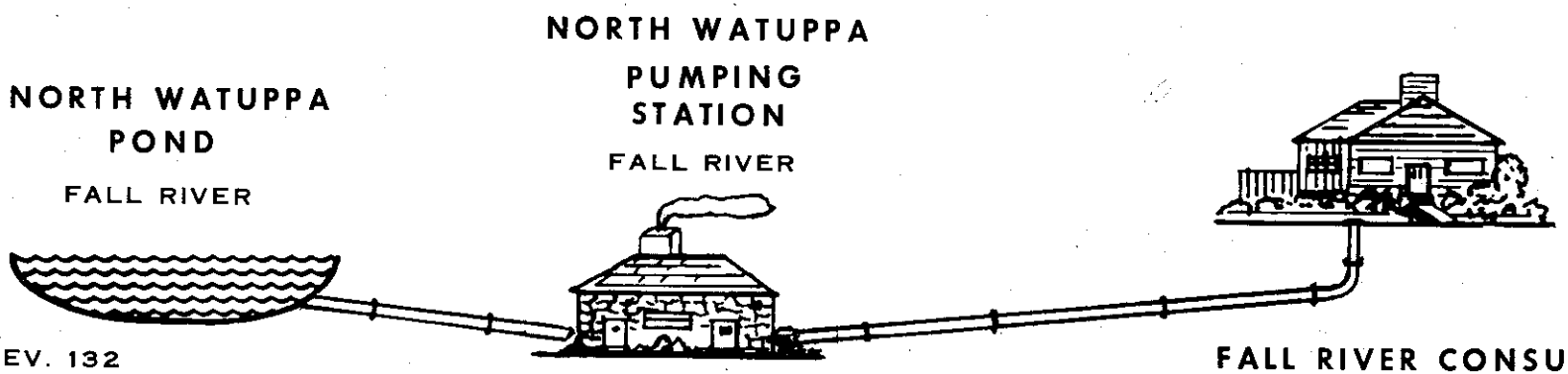
PLATE NO. 1



WATER AREA	6.31 SQ. MI.
WATERSHED AREA	25.98 SQ. MI.
CAPACITY	14,920 MIL. GAL.

NEW BEDFORD WATER SUPPLY SYSTEM

PLATE NO. 2

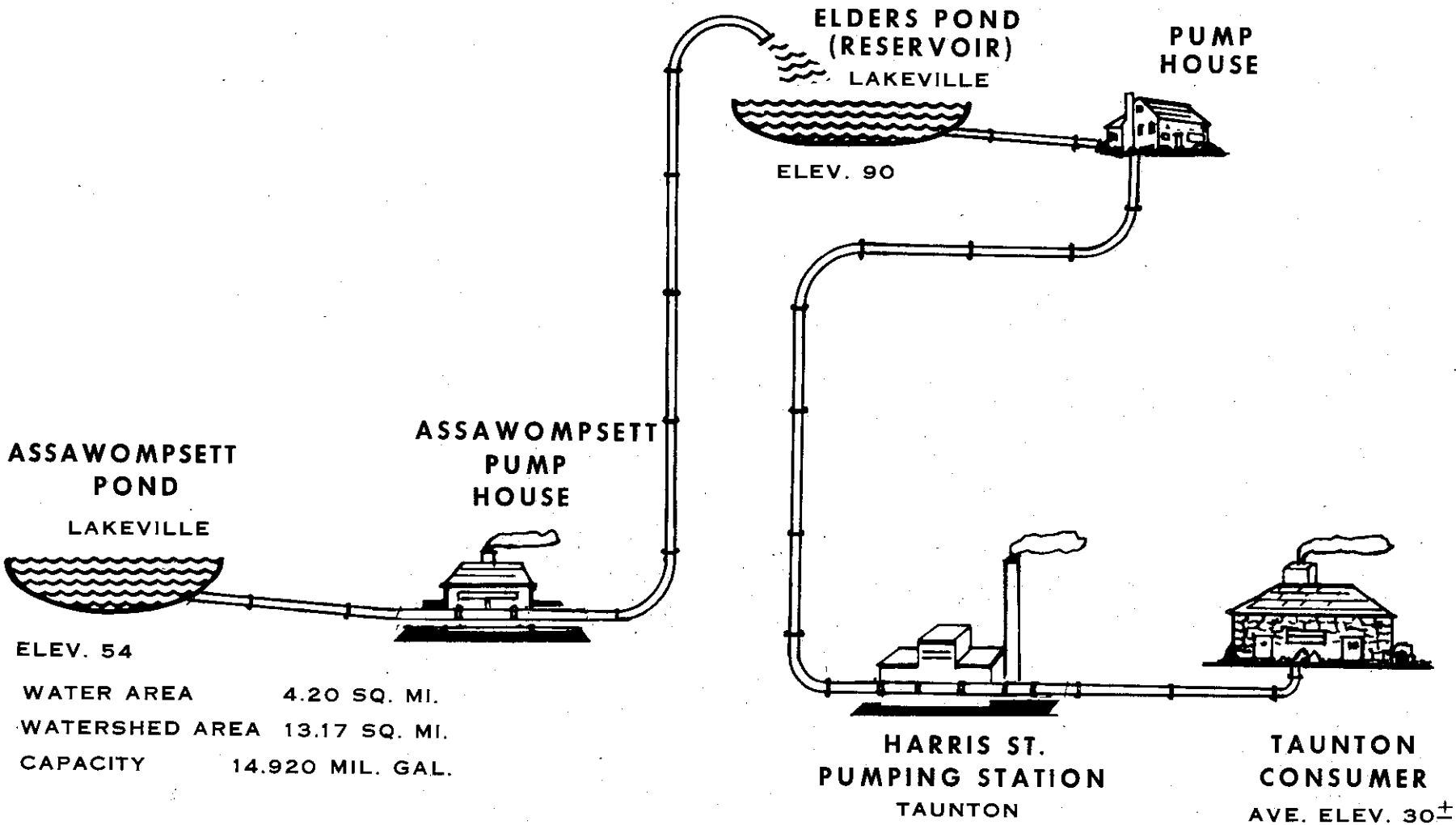


WATER AREA 2.8 SQ. MI.

WATERSHED AREA 8.5 SQ. MI.

FALL RIVER WATER SUPPLY SYSTEM

PLATE NO. 3



TAUNTON WATER SUPPLY SYSTEM

PLATE NO. 4